International Journal of Public Health Science (IJPHS)
Vol. 14, No. 3, September 2025, pp. 1620~1628
ISSN: 2252-8806, DOI: 10.11591/ijphs.v14i3.26155

Assessment of depression, malnutrition and co-morbidities of geriatric individuals in rural areas of Bangladesh

Mst. Umme Hafsa Begum[1], Md. Nazrul Islam[1,2], Afsana Akter[1], Lima Akter[1], Mst. Trisha Akter[1], Md. Abul Hasnat[1], Mst. Rokshana Rabeya[1,3]
[1]Department of Public Health Nutrition, Primeasia University, Dhaka, Bangladesh
[2]Department of Community Health & Epidemiology, University of Saskatchewan, Saskatchewan, Canada
[3]Department of Public Health, Canadian University of Bangladesh, Dhaka, Bangladesh

Article Info

Article history:

Received Oct 27, 2024
Revised Dec 29, 2024
Accepted Mar 6, 2025

Keywords:

Bangladesh
Co-morbidities
Depression
Geriatric
Malnutrition

ABSTRACT

In rural Bangladesh, elderly populations face distinct health challenges, with depression, malnutrition, and co-morbidities significantly impacting their well-being. This cross-sectional study evaluated 384 older adults across four divisions of Bangladesh using the geriatric depression scale (GDS-15), mini nutritional assessment (MNA), and Katz Index of activities of daily living (ADL). Depression was found among 62.8% of respondents. About 13.0% of participants were malnourished, and 51.8% were at risk of malnutrition. Self-reported hypertension (47.1%), arthritis (46.4%), dental problems (43.5%), and insomnia (37.0%) were profound among respondents. The risk of dementia, anorexia, cardiovascular disease, and hypertension was higher among males than females. Geriatric depression was significantly higher in the elderly who were residing in a nuclear family than their counterparts (AOR = 2.114; 95% CI = 1.328-3.365). Additionally, being unemployed was identified as an independent predictor of GD (AOR = 1.992, 95% CI: 1.070-3.709, p = .030). The higher prevalence of depression and risk of malnutrition highlight the pressing requirement for well-coordinated and comprehensive healthcare strategies. The development of multifaceted approaches, incorporating mental health services, nutritional interventions, and socioeconomic support, would enhance elders' well-being.

Corresponding Author:

Mst. Rokshana Rabeya
Department of Public Health Nutrition, Primeasia University
Rangs RL Square, Pragati Sharani, Bir Uttam Rafiqul Islam Ave, Dhaka-1212, Bangladesh
Email: rokshana.rabeya@cub.edu.bd

1. INTRODUCTION

The process of aging is a continuous biological phenomenon characterized by an inherent progression that is largely beyond human intervention [1]. In demographic terms, the elderly population is defined as individuals 60 years of age and older [2]. This age group is particularly vulnerable to a variety of non-communicable diseases (NCDs), such as mental health disorders, malnutrition, diminished functional capacity, deterioration of skills, and risk of contracting infectious diseases [3].

The world geriatric population was 1 billion in 2020, and it is predicted to double by 2050 [4]. This trend of population aging is a pervasive global phenomenon, with Bangladesh also experiencing significant demographic shifts in this regard [5]. Among the 160 million population of Bangladesh, about 7% of the population is above 60 years old [6]. The phenomenon of accelerated aging in Bangladesh is influenced by factors such as widespread poverty, labor-intensive employment, malnutrition, prevalent health issues, and geographic conditions [2].

Depression is characterized by a combination of negative feelings such as sadness, loneliness, irritability, worthlessness, hopelessness, agitation, and guilt, accompanied by an array of physical symptoms [7]. This mental health condition is a significant global issue, particularly prevalent among the elderly population and linked with nutritional conditions [8]. Depression can lead to detrimental consequences such as reduced social functioning, health deterioration, and increased medical burden [9]. Among the elderly, depression can markedly elevate morbidity and mortality rates, akin to the effects of malnutrition [10]. In this phase of life, they have increased expectations from their families, and many of their preferred activities remain unmet. As a result, they experienced a sense of emptiness and a decline in daily life enjoyment, leading to higher levels of depression [11].

Malnutrition is a well-documented yet often underrecognized disorder characterized by a deficiency, excess, or imbalance in energy, protein, and other nutrient intake, affecting the body's shape, size, composition, and function and potentially leading to clinical illness [12]. Older adults face a heightened risk of malnutrition owing to their reduced consumption of food and increased nutritional demands stemming from diverse medical conditions [13]. Prior research has shown that malnutrition is linked to higher morbidity and mortality rates in diseased states and adversely affects recovery outcomes [14]. The high rates of long-term impairments and social isolation may serve as indirect factors leading to psychiatric disorders like depression, which are often associated with anorexia and inadequate food consumption [15]. Malnutrition exacerbates physical deterioration and muscle wasting, reducing independence and frequently leading to falls and fractures [16]. Literature also indicates that elderly individuals in our society face a broad spectrum of social, mental, medical, and economic challenges. In Bangladesh, older adults experience these challenges more acutely due to their advanced age [17].

While several studies addressed geriatric malnutrition and depression among elderly populations, we found a gap in the literature regarding the association of depression with malnutrition, including co-morbidities in the context of this study setting. Thus, this study aimed to assess the condition of mental health, malnutrition, and the co-morbidities of rural geriatric people in Bangladesh. The study's outcomes may aid the healthcare system in crafting strategies and interventions to effectively prevent these widespread conditions and enhance the health status of rural elderly individuals in Bangladesh.

2. METHOD

2.1. Study design, setting, and population

This cross-sectional study was conducted in randomly selected rural areas of the Gazipur, Kishoreganj, Munshiganj, Narayanganj, Cox's Bazar, Chandpur, Kurigram, Rangpur, and Barguna districts under four different divisions in Bangladesh. The study focused on geriatric individuals aged 60 years and above in the selected areas of Bangladesh between the period of March 2023 and September 2023. The individuals who were unwilling or unable to participate due to communication issues or severe illness were excluded from the sampling frame.

2.2. Sampling and sample size calculation

Data was obtained from participants following a simple random sampling method. The sample size was calculated using the formula $n = Z^2pq/d^2$, where n is the required sample size, Z is the standard normal deviation (equivalent to 1.96 for a 95% CI), p is the prevalence of depression 55.5% or 0.55 [18], q is 1 - p and d is the allowable error (5% or 0.05). Finally, the yielded sample size was 380.

2.3. Measures

2.3.1. Data collection tools

Data was collected through face-to-face interviews using a structured questionnaire developed in English and subsequently translated into the local language (Bangla). Informed consent was obtained from each participant or their support before the interview. The study's purpose and significance were explained in the local language.

2.3.2. Demographic information

Demographic and socio-economic information was collected during the home interview. The demographic variables included the age and sex of the respondent. The respondent's socioeconomic status (SES) was indicated by education and monthly family income in Bangladeshi Taka (BDT). Income was further categorized into three categories to determine the low (less than 10,000 BDT), middle (10,000 to 40,000 BDT), and higher income (more than 40,000 BDT) categories following the World Bank Atlas method income classification [19].

2.3.3. Depression assessment

Depression was assessed using the geriatric depression scale (GDS) 15-short form, a validated tool effective in detecting depression in older adults. This scale consists of 15 yes/no questions reflecting the participants' feelings over the past week on satisfaction with life in various aspects, including hopelessness, and helplessness, with scores ranging from 0-4 indicating no depression, 5-8 mild depression, 9-11 moderate depression, and 12-15 severe depression [20]. Furthermore, GDS was categorized as depression present (Score 5-15) and depression absent (score 0-4).

2.3.4. Nutritional status assessment

Nutritional status was evaluated using the mini nutritional assessment (MNA), a validated tool widely used to measure the nutritional status of the geriatric population group. The MNA consists of 18 questions and a total score of 30 aimed at identifying the level of nutritional status. The four questions in MNA were about anthropometric assessment, which includes body mass index (BMI), mid-upper arm circumference (MUAC), calf circumference (CC), and weight loss during the last three months. A stadiometer was used to record height, measured without shoes to the nearest 0.1 cm, and a digital scale was used to measure the body weight. The Asian BMI cut-off points were applied to categorize participants' nutritional status [21]. There were six general assessment questions under MNA related to lifestyle, medication, mobility, psychological or acute disease, neurological problems, pressure sores, or skin disease in the past three months. The dietary assessment of MNA includes six questions related to the number of meals, food and fluid intake, and mode of feeding. Self-assessment was done by asking two questions, including self-perception of health and nutrition. Finally, the MNA score was divided into three categories: an MNA score below 17 indicates malnutrition, between 17-23.5 risk of malnutrition, and 24 and above indicates well-nourished [22].

2.3.5. Functional status assessment

The functional status of participants was assessed with the Katz Index of independence in activities of daily living (Katz ADL). This tool was used to assess the functional status of the respondents as a measurement of their ability to perform their daily living activities independently. The index ranks adequacy of performance in the six functions, including bathing, dressing, toileting, transferring, continence, and feeding. The scoring was determined by taking respondents' answers by yes/no for independence in each of the six functions. Scores ranging from 0-4 indicate severe impairment, 4-5 indicate moderate impairment, and 6 indicates independence [23].

2.3.6. Comorbidities assessment

The respondents were asked whether they have comorbidities such as diabetes, asthma/chronic obstructive pulmonary disease (COPD), hypertension, cardiovascular diseases (CVD), and kidney disease. The presence of disease was verified through previous medical records, validated test reports, or discussions with family members. The answers to each question were obtained using yes and no responses.

2.4. Data management, quality control, and analysis plan

A trained group of nutrition graduate students was responsible for data collection. A draft questionnaire was developed according to the study objectives, pre-tested for data quality, and revised as necessary. Data quality was ensured through consistent checking and supervision for completeness and consistency. All data were edited, coded, and analyzed using Statistical Package for the Social Sciences (SPSS) version 22. Incomplete data was excluded from the dataset before analysis. Descriptive statistics were performed to evaluate the variables through the calculation of frequencies and proportions. The associations between variables were evaluated using the Chi-square test, and only significant variables were incorporated into the logistic regression model ($p<0.05$). The strength of associations was expressed through adjusted odds ratios (AOR) and their 95% confidence intervals (CI).

3. RESULTS AND DISCUSSION

3.1. Socio-demographic and depression among elderly people

A total of 384 participants were involved in this cross-sectional study. The majority of respondents were between 60 and 75 years old (85.7%), with a mean age of 67.95 years (SD±8.026). The gender distribution was relatively balanced, with 58.3% females and 41.7% males. Joint family living arrangements were prevalent among 58.9% of participants. A significant portion of the respondents had no formal education (79.4%), and 64.3% were unemployed. Most households were in the middle-income level (60.3%). Additionally, 21.1% of the participants reported being smokers, as shown in Table 1. The prevalence of depression was notably high at approximately 62.8%. The incidence of depression was higher among females (72.3%) compared to males

(49.4%). Conversely, 37.2% of the respondents showed no signs of depression shown in Table 1. The previous study in different regions of Bangladesh found 55.5% of GD among rural individuals, which is lower than that of this study [18]. Some recent studies in different regions of Bangladesh indicated between 81.5% and 83.75% of older adults experienced varying levels of depressive symptoms, which is slightly higher than that found in this study [5], [24]. These variations in depression prevalence among the elderly population may be attributed to differences in the sociodemographic characteristics of the study participants [8]. The study showed a significant association between depression and female gender, living in a nuclear family, unemployment, low household income, and smoking habits. The prevalence of depression was higher among females in our study, aligning with findings from prior research [25].

Table 1. Descriptive statistics of demographic variables and association with geriatric depression

Variables	Category	All participants n = 384 (100%)	Depression present n =241(62.8%)	Depression absent n = 143(37.2%)	p-value
Age group	Young old (60-75 years)	329 (85.7%)	205 (62.3%)	124 (37.7%)	
	Old (76-85 years)	43 (11.2%)	26 (60.5%)	17 (39.5%)	0.317
	Oldest old (>85 years)	12 (3.1%)	10 (83.3%)	2 (16.7%)	
Gender	Male	160 (41.7%)	79(49.4%)	81(50.6%)	
	Female	224 (58.3%)	162 (72.3%)	62 (27.7%)	0.000
Religion	Islam	319 (83.1%)	192 (60.2%)	127 (39.8%)	
	Hindu	37 (9.6%)	32 (86.5%)	5 (13.5%)	0.007
	Christian	28 (7.3%)	17 (60.7%)	11 (39.3%)	
Type family	Nuclear	158 (41.1%)	113 (71.5%)	45 (28.5%)	
	Joint	226 (58.9%)	128 (56.6%)	98 (43.4%)	0.003
Educational qualification	No formal education	305 (79.4%)	187 (61.3%)	118 (38.7%)	
	Primary	57 (14.8%)	41 (71.9%)	16 (28.1%)	0.294
	Secondary and above	22 (5.7%)	13 (59.1%)	9 (40.9%)	
Employment	Unemployed	247 (64.3%)	177 (71.7%)	70 (28.3%)	
	Employed	137 (35.7%)	64 (46.7%)	73 (53.3%)	0.000
Household monthly income	Low income	79 (20.6%)	61 (77.2%)	18 (22.8%)	
	Middle income	221 (60.3%)	142 (61.5%)	89 (38.5%)	
	Higher income	74 (19.3%)	38 (51.4%)	36 (48.6%)	0.003
Smoking	Yes	81 (21.1%)	43 (53.1%)	38 (46.9%)	
	No	303 (78.9%)	198 (65.3%)	105 (34.7%)	0.030

3.2. Morbidity characteristics of the participants

The self-reported gender-based comorbidities among elderly individuals are shown Table 2. Hypertension was found in 47.1% of the participants, with a notably higher percentage among females compared to males (51.8% vs. 40.6%), which is statistically significant (p = 0.031). This percentage aligns closely with findings from a study conducted in Zambia [26]. Additionally, a greater proportion of females (55.4%) reported arthritis in contrast to males (33.8%). Furthermore, anorexia, dementia, and chewing difficulty were significantly higher among males compared to females. Diabetes and CVD prevalence in this study was found to be almost similar to a study conducted in North America's country [27]. In contrast with this study, visual and hearing problems were higher in males in another Bangladeshi study [6].

3.3. Nutritional status of participants

Based on the Mini Nutritional Assessment, the majority of respondents (51.8%) were at risk of malnutrition. Additionally, 13.0% of the respondents were malnourished, while the remaining 35.2% were well-nourished in Table 3. Similarly, another study in Bangladesh in different regions observed a higher prevalence of malnutrition risk than of malnutrition [6]. In line with these findings, a study conducted in Nepal reported that the risk of malnutrition was nearly double that of the actual occurrence of malnutrition [28]. Our study also identified that the prevalence of depression was higher in individuals who were malnourished and had severe impairment. Research in Mexico found an inverse correlation between MNA evaluations and depression scores; residents with a better nutritional status had lower depression scores [27].

3.4. Functional status of the rural elderly people

Based on the Katz Index of activity of daily living (ADL), most of the respondents (79.7%) were classified as independent. A small portion (2.9%) exhibited severe impairment. The remaining 17.4% had moderate impairment, as shown in Table 3.

Table 2. Morbidity characteristics of the respondents (N = 384)

Variables	Category	Present	Absent	Total	p-value
Hypertension	Male	65 (40.6%)	95 (59.4%)	160 (100%)	0.031
	Female	116 (51.8%)	108 (48.2%)	224 (100%)	
	Total	181 (47.1%)	203 (52.9%)	384 (100%)	
Diabetes	Male	29 (18.1%)	131 (81.9%)	160 (100%)	0.111
	Female	56 (25.0%)	168 (75.0%)	224 (100%)	
	Total	85 (22.1%)	299 (77.9%)	384 (100%)	
Cardiovascular disease	Male	21 (13.1%)	139 (86.9%)	160 (100%)	0.361
	Female	37 (16.5%)	187 (83.5%)	224 (100%)	
	Total	58 (15.1%)	326 (84.9%)	384 (100%)	
Asthma/COPD	Male	25 (15.6%)	135 (84.4%)	160 (100%)	0.716
	Female	32 (14.3%)	192 (85.7%)	224 (100%)	
	Total	57 (14.8%)	327 (85.2%)	384 (100%)	
Kidney disease	Male	13 (8.1%)	147 (91.9%)	160 (100%)	0.142
	Female	10 (4.5%)	214 (95.5%)	224 (100%)	
	Total	23 (6.0%)	361 (94.0%)	384 (100%)	
Arthritis	Male	54 (33.8%)	106 (66.3%)	160 (100%)	0.000
	Female	124 (55.4%)	100 (44.6%)	224 (100%)	
	Total	178 (46.4%)	206 (53.6%)	384 (100%)	
Visual problem	Male	67 (41.9%)	93 (58.1%)	160 (100%)	0.161
	Female	110 (49.1%)	114 (50.9%)	224 (100%)	
	Total	177 (46.1%)	207 (53.9%)	384 (100%)	
Hearing problem	Male	51 (31.9%)	109 (68.1%)	160 (100%)	0.434
	Female	80 (35.7%)	144 (64.3%)	224 (100%)	
	Total	131 (34.1%)	253 (65.9%)	384 (100%)	
Dental problem	Male	56 (35.0%)	104 (65.0%)	160 (100%)	0.005
	Female	111 (49.6%)	113 (50.4%)	224 (100%)	
	Total	167 (43.5%)	217 (56.5%)	384 (100%)	
Anorexia	Male	43 (26.9%)	117 (73.1%)	160 (100%)	0.002
	Female	95 (42.4%)	129 (57.6%)	224 (100%)	
	Total	138 (35.9%)	246 (64.1%)	384 (100%)	
Dementia	Male	25 (15.6%)	135 (84.4%)	160 (100%)	0.003
	Female	65 (29.0%)	159 (71.0%)	224 (100%)	
	Total	90 (23.4%)	294 (76.6%)	384 (100%)	
Chewing difficulty	Male	31 (19.4%)	129 (80.6%)	160 (100%)	0.016
	Female	68 (30.4%)	156 (69.6%)	224 (100%)	
	Total	99 (25.8%)	285 (74.2%)	384 (100%)	
Insomnia	Male	53 (33.1%)	107 (66.9%)	160 (100%)	0.187
	Female	89 (39.7%)	135 (60.3%)	224 (100%)	
	Total	142 (37.0%)	242 (63.0%)	384 (100%)	

Table 3. Association between co-morbidities and geriatric depression

Variables	Category	Total n (%)	Depression present n (%)	Depression absent n (%)	p-value
Hypertension	Yes	181 (47.1%)	117 (64.6%)	64 (35.4%)	0.472
	No	203 (52.9%)	124 (61.1%)	79 (38.9%)	
Anorexia	Yes	138 (35.9%)	92 (66.7%)	46 (33.3%)	0.236
	No	246 (64.1%)	149 (60.6%)	97 (39.4%)	
Dementia	Yes	90 (23.4%)	70 (77.8%)	20 (22.2%)	0.001
	No	294 (76.6%)	171 (58.2%)	123 (41.8%)	
Insomnia	Yes	142 (37.0%)	101 (71.1%)	41 (28.9%)	0.009
	No	242 (63.0%)	140 (57.9%)	102 (42.1%)	
Functional status	Severe impairment	11 (2.9%)	10 (90.9%)	1 (9.1%)	0.016
	Moderate impairment	67 (17.45)	49 (73.1%)	18 (26.9%)	
	Independent	306 (79.7)	182 (59.5%)	124 (40.5%)	
Nutritional status	Malnourished	50 (13%)	41 (82.0%)	9 (18.0%)	0.009
	At risk of malnutrition	199 (51.8%)	122 (61.3%)	77 (38.7%)	
	Well Nourished	135 (35.2%)	78 (57.8%)	57 (42.2%)	

3.5. Association between co-morbidities and geriatric depression

Table 3 shows the association between co-morbidities, nutritional status, and geriatric depression through the Chi-square test. The presence of comorbidities such as dementia ($p = 0.001$) and insomnia ($p = 0.009$) were significantly associated with GD, which is consistent with a previous study [29]. Our analysis also revealed significant variations in GD concerning the functional and nutritional status of the participants. Specifically, individuals with severe impairment showed a significantly higher prevalence of depression compared to those with normal functional status (independent) ($p = 0.016$). Furthermore, malnourished individuals exhibited a higher prevalence of depression compared to well-nourished individuals ($p = 0.009$).

3.6. Determination of independent predictors of geriatric depression

The risk factors associated with depression were determined through regression analysis and are presented in Table 4. The analysis revealed that individuals residing in nuclear families were at 2.114 times higher risk of experiencing depression (AOR = 2.114, 95% CI: 1.328-3.365, p = 0.002). Additionally, being unemployed was identified as an independent predictor of geriatric depression (AOR = 1.992, 95% CI: 1.070-3.709, p = 0.030). Our study has also identified that respondents residing in the nuclear family were 2.11 times more likely to be depressed than those living in joint families, a similar finding has been reported in another research in Pakistan [30].

In this study, the prevalence of depression was high in unemployed individuals. A recent study in Korea revealed that depressive symptoms are more likely among unemployed senior citizen than their counterpart [31]. The risk of depression was two times higher among unemployed elderly than among their counterparts in this study. That was almost half of a study in Bangladesh that reported the risk of depression is 4.96 times higher in unemployed elderly [8]. In the rural areas of Bangladesh, older adults are frequently unemployed and dependent on family members, causing financial insecurity, limited availability of nutritious food, poor living conditions, and inadequate access to essential health services [8].

Table 4. Factors associated with geriatric depression

Factors	95% Confidence interval		
	AOR	Lower CI - Upper CI	p-value
Gender (male)	0.618	0.336 - 1.138	0.122
Family type (nuclear)	2.114	1.328 - 3.365	0.002
Employment (unemployed)	1.992	1.070 - 3.709	0.030
Dementia (yes)	1.577	0.848 - 2.931	0.150
Insomnia (yes)	1.458	0.896 - 2.375	0.129
ADL (severe impairment)	4.598	0.535 - 39.524	0.165
ADL (moderate impairment)	1.358	0.714 - 2.583	0.350
Nutritional status (malnutrition)	1.616	0.665 - 3.925	0.289
Nutritional status (at risk)	0.925	0.569 - 1.501	0.751

AOR: adjusted odds ratio

4. CONCLUSION

This study revealed a high prevalence of depression among rural elderly in Bangladesh, with over half at risk of malnutrition. Living in a nuclear family, being unemployed, insomnia, and dementia emerged as independent predictors of geriatric depression. High prevalence rates of these conditions highlight the urgent need for comprehensive and coordinated healthcare strategies. To address these challenges, establishing a robust healthcare framework with adequate resources for both physical and mental healthcare, including enhanced mental health services, nutritional support programs, and improved chronic disease management, is imperative. This cross-sectional study was limited to rural areas of Bangladesh and utilized previous medical records along with family interviews to identify participants' comorbidities. In the future, a longitudinal study with appropriate sampling, incorporating direct observation of elderly individuals' food quality and quantity, continuous assessment of mental health status, and comprehensive medical and biochemical examinations to confirm comorbidities, could provide deeper insights and enhance generalizability to the broader population

ACKNOWLEDGEMENTS

We extend our heartfelt gratitude to the elderly participants whose involvement was crucial to the successful completion of this study.

FUNDING INFORMATION

This research did not receive financial support from any public, commercial, or nonprofit organizations.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Mst.Umme Hafsa Begum			✓		✓			✓	✓	✓	✓			
Md Nazrul Islam		✓	✓		✓			✓	✓	✓	✓			
Afsana Akter	✓	✓		✓				✓	✓	✓				
Lima Akter	✓							✓	✓	✓				
Mst. Trisha Akter	✓							✓	✓	✓				
Md Abul Hasnat	✓							✓	✓	✓				
Mst. Rokshana Rabeya	✓	✓				✓	✓			✓		✓	✓	

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors of this study stated that they have no conflicts of interest at any stage of the research.

INFORMED CONSENT

Written informed consent was obtained from each respondent after explaining the study's purpose and ensuring confidentiality and the right to refuse participation. The data collection team adhered strictly to privacy protocols.

ETHICAL APPROVAL

The study was approved by the Institutional Ethical Approval Committee (IEAC) at Primeasia University in Dhaka, Bangladesh (approval number PAU/IEAC/23/118).

DATA AVAILABILITY

Data and materials may be available on reasonable request to the corresponding author.

REFERENCES

[1] R. F. Walker, "A mechanistic theory of development-aging continuity in humans and other mammals," *Cells*, vol. 11, no. 5, p. 917, Mar. 2022, doi: 10.3390/cells11050917.
[2] K. M. M. Rahman, *Unnayan Onneshan Policy Brief on Present Social Context and Elderly Population in Bangladesh*. Unnayan Onneshan – The Innovators, Dhaka, Bangladesh, 2023.
[3] M. Karthika, J. Abraham, P. B. Kodali, and E. Mathews, "Emerging trends of chronic diseases and their care among older persons globally," in *Handbook of Aging, Health and Public Policy*, Singapore: Springer Nature Singapore, 2023, pp. 1–24. doi: 10.1007/978-981-16-1914-4_198-1.
[4] World Health Organization (WHO), "Ageing and health." Accessed: Sep. 28, 2024. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health.
[5] M. R. Alam, S. Karmokar, S. Reza, Md. R. Kabir, S. Ghosh, and Md. A. A. Mamun, "Geriatric malnutrition and depression: Evidence from elderly home care population in Bangladesh," *Preventive Medicine Reports*, vol. 23, p. 101478, Sep. 2021, doi: 10.1016/j.pmedr.2021.101478.
[6] A. H. Razon, M. I. Haque, M. F. Ahmed, and T. Ahmad, "Assessment of dietary habits, nutritional status and common health complications of older people living in rural areas of Bangladesh," *Heliyon*, vol. 8, no. 2, p. e08947, Feb. 2022, doi: 10.1016/j.heliyon.2022.e08947.
[7] E. Denton, "Depression: Symptoms," in *Encyclopedia of Behavioral Medicine*, M. D. Gellman, Ed., Cham: Springer International Publishing, 2020, pp. 631–633. doi: 10.1007/978-3-030-39903-0_1121.
[8] Md. Z. Islam, T. R. Disu, S. Farjana, and M. M. Rahman, "Malnutrition and other risk factors of geriatric depression: a community-based comparative cross-sectional study in older adults in rural Bangladesh," *BMC Geriatr*, vol. 21, no. 1, p. 572, Dec. 2021, doi: 10.1186/s12877-021-02535-w.
[9] Wu Tsai Neurosciences Institute, "The devastating ways depression and anxiety impact the body," Accessed: Nov. 16, 2024. [Online]. Available: https://neuroscience.stanford.edu/news/devastating-ways-depression-and-anxiety-impact-body.
[10] A. Gingrich *et al.*, "Prevalence and overlap of sarcopenia, frailty, cachexia and malnutrition in older medical inpatients," *BMC Geriatr*, vol. 19, no. 1, p. 120, Dec. 2019, doi: 10.1186/s12877-019-1115-1.
[11] M. Moeyersons, K. De Vliegher, B. Huyghe, S. De Groof, K. Milisen, and B. D. De Casterlé, "'Living in a shrinking world'—The experience of loneliness among community-dwelling older people with reduced mobility: a qualitative grounded theory approach," *BMC Geriatrics*, vol. 22, no. 1, p. 285, Dec. 2022, doi: 10.1186/s12877-022-02998-5.
[12] D. L. Humphries, M. E. Scott, and S. H. Vermund, Eds., *Nutrition and Infectious Diseases: Shifting the Clinical Paradigm*. Cham: Springer International Publishing, 2021. doi: 10.1007/978-3-030-56913-6.

[13] E. Dent, O. R. L. Wright, J. Woo, and E. O. Hoogendijk, "Malnutrition in older adults," *The Lancet*, vol. 401, no. 10380, pp. 951–966, Mar. 2023, doi: 10.1016/S0140-6736(22)02612-5.
[14] M. Urquiza, N. Fernandez, I. Arrinda, I. Sierra, J. Irazusta, and A. Rodriguez Larrad, "Nutritional status is associated with function, physical performance and falls in older adults admitted to geriatric rehabilitation: a retrospective cohort study," *Nutrients*, vol. 12, no. 9, p. 2855, Sep. 2020, doi: 10.3390/nu12092855.
[15] I. Aprahamian *et al*., "The concept of anorexia of aging in late life depression: A cross-sectional analysis of a cohort study.," *Archives of Gerontology and Geriatrics*, vol. 95, p. 104410, Jul. 2021, doi: 10.1016/j.archger.2021.104410.
[16] M. Kupisz-Urbanska and E. Marcinowska-Suchowierska, "Malnutrition in older adults—effect on falls and fractures: a narrative review," *Nutrients*, vol. 14, no. 15, p. 3123, Jul. 2022, doi: 10.3390/nu14153123.
[17] H. Mazumder, M.-E. Murshid, F. Faizah, and M. M. Hossain, "Geriatric mental health in Bangladesh: a call for action," *International Psychogeriatrics*, vol. 32, no. 5, pp. 667–668, May 2020, doi: 10.1017/S1041610220000423.
[18] Md. S. Rahman *et al.*, "Determinants of depressive symptoms among older people in Bangladesh," *Journal of Affective Disorders*, vol. 264, pp. 157–162, Mar. 2020, doi: 10.1016/j.jad.2019.12.025.
[19] The World Bank "The World Bank Atlas method - detailed methodology – World Bank Data Help Desk." Accessed: Sep. 30, 2024. [Online]. Available: https://datahelpdesk.worldbank.org/knowledgebase/articles/378832-what-is-the-world-bank-atlas-method
[20] D. Papadopoulos, "Sociodemographic factors' association with community-dwelling older adults' psychosocial wellbeing: the greek context," *Psychology* , vol. 11, no. 02, pp. 340–363, 2020, doi: 10.4236/psych.2020.112022.
[21] C. B. Weir and A. Jan, "BMI classification percentile and cut off points," in *StatPearls*, Treasure Island (FL): StatPearls Publishing, 2024. Accessed: Nov. 30, 2024. [Online]. Available: http://www.ncbi.nlm.nih.gov/books/NBK541070/
[22] Y. Guigoz and B. Vellas, "Nutritional assessment in older adults: MNA® 25 years of a screening tool & a reference standard for care and research; what next?," *The Journal of Nutrition, Health And Aging*, vol. 25, no. 4, pp. 528–583, Apr. 2021, doi: 10.1007/s12603-021-1601-y.
[23] M. Pashmdarfard and A. Azad, "Assessment tools to evaluate activities of daily living (ADL) and instrumental activities of daily living (IADL) in older adults: A systematic review," *Medical Journal of The Islamic Republic of Iran (MJIRI)*, vol. 34, p. 33, Apr. 2020, doi: 10.34171/mjiri.34.33.
[24] T. Tasnim, M. Z. A. Sadiq, and K. M. R. Karim, "Depression level, nutritional status, and dietary nutrient intake of the older adult at the community level in a selected area of Bangladesh," *Heliyon*, vol. 9, no. 7, p. e18199, Jul. 2023, doi: 10.1016/j.heliyon.2023.e18199.
[25] Y. Zenebe, B. Akele, M. W/Selassie, and M. Necho, "Prevalence and determinants of depression among old age: a systematic review and meta-analysis," *Annals of General Psychiatry*, vol. 20, no. 1, p. 55, Dec. 2021, doi: 10.1186/s12991-021-00375-x.
[26] G. Maila, K. Audain, and P. A. Marinda, "Association between dietary diversity, health and nutritional status of older persons in rural Zambia," *South African Journal of Clinical Nutrition*, vol. 34, no. 1, pp. 34–39, May 2021, doi: 10.1080/16070658.2019.1641271.
[27] M. C. Velázquez-Alva *et al*., "Prevalence of malnutrition and depression in older adults living in nursing homes in Mexico City," *Nutrients*, vol. 12, no. 8, p. 2429, Aug. 2020, doi: 10.3390/nu12082429.
[28] M. K. Tamang *et al*., "Nutritional assessment and factors associated with malnutrition among the elderly population of Nepal: a cross-sectional study," *BMC Research Notes*, vol. 12, no. 1, p. 246, Dec. 2019, doi: 10.1186/s13104-019-4282-4.
[29] K. Tsaras, M. Tsiantoula, I. V. Papathanasiou, D. Papagiannis, M. Chatzi, and E. C. Fradelos, "Predictors of depression and insomnia in community-dwelling elderly people: a cross-sectional evidence of their bidirectional relationship," *Cureus*, Mar. 2021, doi: 10.7759/cureus.13965.
[30] M. Fatima, A. Sehar, M. Ali, A. Iqbal, and F. Shaukat, "Incidence of depression among community dwelling healthy elderly and the predisposing socio-environmental factors," *Cureus*, Mar. 2019, doi: 10.7759/cureus.4292.
[31] S. Park *et al*., "Association of geriatric depressive symptoms and government-initiated senior employment program: a population-based study," *Psychiatry Investigation*, vol. 21, no. 3, pp. 284–293, Mar. 2024, doi: 10.30773/pi.2023.0212.

BIOGRAPHIES OF AUTHORS

Mst. Umme Hafsa Begum is an assistant professor and nutritionist who has completed her post-graduation in applied nutrition and food technology. She has a strong interest in research and education related to nutrition and food science, public health, obesity and fitness, and food product development. Currently, she works as an assistant professor in the Department of Public Health Nutrition at a renowned private university in Bangladesh. In addition to her academic role, she has four years of experience as a nutritionist in a multinational wellness organization. Currently, she is engaged in developing a ready-to-drink food product aimed at reducing mineral deficiencies in adolescent girls and conducting a cross-sectional study on the nutritional assessment of cancer patients. She can be contacted at email: hafsa.begum@primeasia.edu.bd.

Md. Nazrul Islam is an enthusiastic public health researcher and has been working on different research projects for the last five years. His research interests include public/human health, nutrition, epidemiology, mental health, adolescent health, reproductive health, and other emerging public health issues. He can be contacted at email: nazrul.i@usask.ca.

Afsana Akter earned her B.Sc. degree in Public Health Nutrition from Primeasia University, Bangladesh. She has a deep interest in the field of Public Health Nutrition, particularly in conducting research, with a focus on improving community health, addressing nutritional challenges, and contributing to sustainable public health interventions for better public health outcomes. She can be contacted at email: afsana.akter4155@gmail.com.

Lima Akter earned her B.Sc. in Public Health Nutrition and is currently pursuing an M.Sc in Food and Nutrition Science. She is working as an Intensive Care Technologist at a renowned private hospital in Bangladesh, where she integrates her clinical expertise with her academic background. She is deeply interested in research and education within the fields of Food and Nutrition Science and Public Health Nutrition. She can be contacted at email: limaakter24680@gmail.com.

Mst. Trisha Akter graduated from Primeasia University in the Public Health Nutrition Department, and is currently working as a presenter in a reputed company. She is very interested in research work related to public health and nutrition. She can be contacted at email: trishaislam4859@gmail.com.

Md. Abul Hasnat is a dedicated professional with a strong academic foundation in healthcare and nutrition. He holds a Diploma from the State Medical Faculty of Bangladesh and a Bachelor's degree in Public Health Nutrition from Primeasia University. Passion lies in advancing research and education in the fields of food science, nutrition science, and public health nutrition. He committed to contributing to impactful studies and initiatives that promote better health and nutrition outcomes. He can be contacted at email: abulhasnat.on@gmail.com

Mst. Rokshana Rabeya is an Associate Professor in the Department of Public Health at the Canadian University of Bangladesh. As a biochemist and public health academician, she is actively involved in various public health research projects, including those focused on non-communicable diseases, nutrition, mental health, and public health information, education, and communications. She also has lab-based research experiences as a Research Fellow in the Department of Molecular Genetics at the Institute of Aging and Cancer (IDAC), which is affiliated with Tohoku University Graduate School of Medicine in Japan. She is particularly interested in exploring areas such as mental health, spiritual health, and social health, with a goal of raising awareness and driving societal change through behavior modification and effective public health education. She can be contacted at email: rokshana.rabeya@cub.edu.bd.